Detection of Dairy Herds at Risk for Changing Salmonella Dublin status

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Detection of Dairy Herds at Risk for Changing *Salmonella* Dublin status

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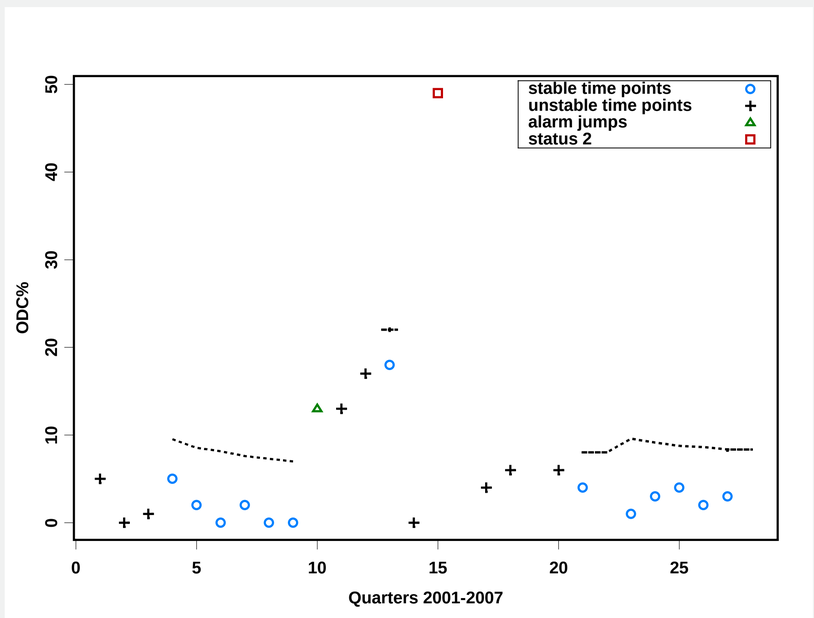
Introduction *Salmonella* Dublin (*S*. Dublin) is a costly infection for dairy cows, potentially lethal to humans. *S*urveillance is based on bulk tank milk (BTM) antibody measurements, taken each quarter of the year. Herds are classified as Status 1- likely free of *S*. Dublin, or Status 2 – likely infected with *S*. Dublin, based on present /recent characteristics, but not actual *S*. Dublin detection. We develop a predictive model based on characteristics from last quarter, using on registry data for 2001-2007 for 9387 herds in Denmark . Only 2004-2007 data modeled due to data contamination.

Methods

Status 2 is given if *mean of the last 4 BTM measurements are above 25,* or *if a jump of at least 20 occurs*.

Non-traditional risk factor:

Alarm Status: leaving a steady BTM antibody progression with a 'sufficently high ' upwards jump (jump to level of at least 13).



Analysis

Previous quarter values of Alarm status, previous BTM antibody values, trade patterns, neighbors (<4.9km) and herd size was entered into a dynamic logistic regression model for herd status change. The linear predictor was used as *risk score index*.

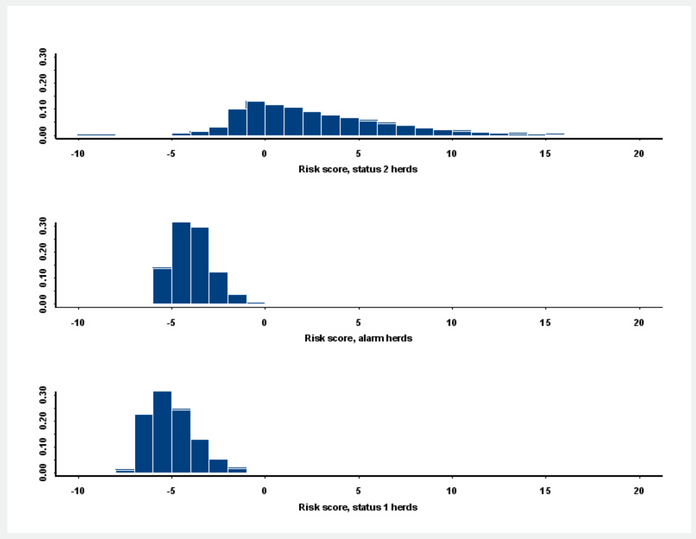
Results

Trade impacted through #trade contacts with Status 2 herds, #animals traded with Status 2 herds, and #animals traded with Status 1 herds.

Neighbors impacted through #Status 2 neighbor farms and #Status 2 neighbor animals; Status 1 neighbors did not impact.

Alarm status and previous values impacted, while herdsize did not.

Risk scores



Alternative classification: Characterize herds prospectively through risk scores. A *Herd At Risk* have risk score above a threshold *r*.

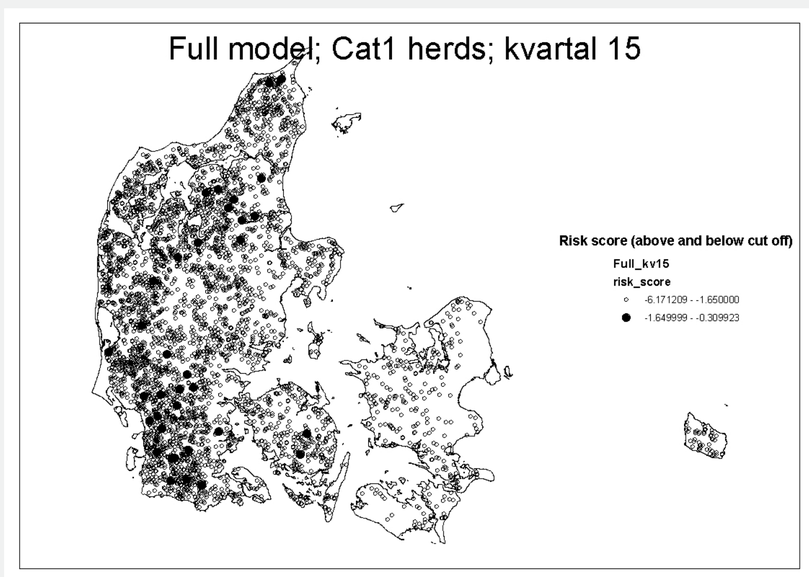
r = -1.05 optimizes status change prediction in current system. With Status 2 changes about 5 times as important to predict than non-changes, the optimal *r* is -1.65 from the gain φ:

$$\varphi(r) = \alpha P(C|PC_r)P(PC_r)+P(C^{\neg}|PC_r^{\neg})P(PC_r^{\neg})$$

where C="Status change", PC_r="Predicted Change" with threshold *r*, ie. "Herd At Risk" status, and α the relative importance of Status 2 herds.

Alarm herds has a status change frequency of 6%, which compares to the overall frequency of 1.6%.

Neighbor effects constitutes a *hidden geographical component* through spatial inhomogeneity of herd density in Denmark.



Conclusion

Alternative classification may be formed with a relatively high level of agreement with the current system, and based on values obtained 3 months earlier, but must conform with legislation. Alternative classification may provide farmers with incentive to contain the risk of an undetected emerging infection.